Title: *Multiscale Magnetosphere-Ionosphere Coupling*

Cluster: *Cross-Theme Theory and Data Analysis/SECTP*

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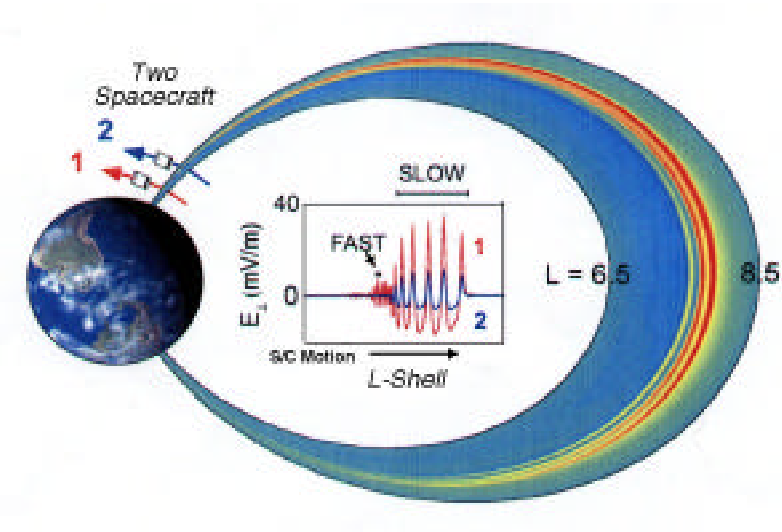
· **Multiscale feedback in the magnetosphere-ionosphere interaction.**

Electrodynamic feedback between the magnetosphere and ionosphere causes oscillating power flows between the two regions that stimulate ultra-low-frequency electromagnetic waves. Simulations by the Dartmouth SECTP group show that the resulting magnetically guided oscillations, known as Alfvén waves, form spatially distinct, multiple wave patterns. These multiscale structures regulate auroral energetic particle precipitation and are sources of intense electric fields at low-altitudes. This finding represents a major advance in the characterization, understanding and prediction of observed variability in high-latitude electron energy fluxes, field-aligned current density and auroral luminosity, which exhibit similar multiscale behavior. Development of quantitative models of multiscale magnetosphere-ionosphere coupling serves NASA's strategic interests in understanding the dynamic response of the geospace environment to solar variability. Such models are an integral part of the planning of future ionosphere and magnetosphere Solar Terrestrial Probe and Living With a Star missions to resolve multiscale processes.

Simulated Observations of Dynamic Magnetosphere-Ionosphere Feedback by Polar-Orbiting Spacecraft Separated 1000 km in Altitude



Resonant, standing Alfvén waves form electromagnetic structures with transverse length scales and periods of oscillation that vary with altitude and latitude. The fastest oscillations would be seen only from the lower altitude satellite orbiting at 4000 km and on the low-latitude side of the active wave region.

Reference: Adapted from Pokhotelov, D., W. Lotko and A. Streltsov, Harmonic structure of field line eigenmodes generated by ionospheric feedback instability, *J. Geophys. Res.*, *107*, 1362, 2002.